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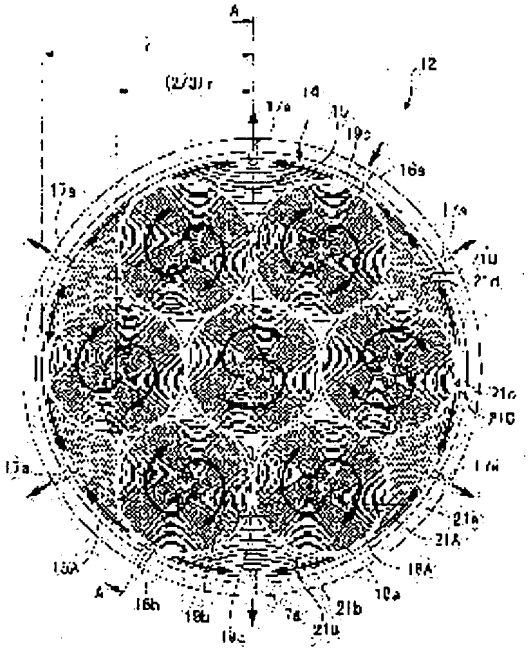
(54) SOLID ELECTROLYTE TYPE FUEL CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To make uniform a distribution of a power output generated inside a single cell by uniformly supplying a reaction gas.

SOLUTION: In an inside of an outer perimeter section 14 of a separator 12 of the solid electrolyte type fuel cell, a fuel-gas supply hole 16a and an oxidizer gas supply hole 16b, and a fuel-gas exhaust nozzles 17a..., 17a and an oxidizer gas exhaust nozzle are prepared. Seven dented parts 18a..., 18a are arranged on a surface 15A of the inner perimeter section 15, and seven dented parts are prepared on the back surfaces. Inside of the inner perimeter section 15, a plurality of pipings 19a, 19b, and 19c for fuel gas which connects the fuel-gas supply hole 16a with insides of the dent parts 18a each other, is arrange. A plurality of the oxidizer gas supply holes which connect the oxidizer gas supply hole 16b with the insides of the dent parts on the back surface of the inner perimeter section, is arranged. Spiral dented grooves 21a,..., 21a for fuel gas which whirl around with each dent part 18a as a center, and spiral grooves for oxidizer gas which whirl around with each dent part on the back surface as a center are arranged.



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CLAIMS

[Claim(s)]
[Claim 1] It is the solid oxide fuel cell equipped with the single cel which consists of a solid electrolyte put with the positive electrode and the negative electrode, and the separator by which the laminating was carried out to said said positive-electrode [of this single cel], and negative-electrode side. Two or more reactant gas supply holes prepared on the front face of said separator, and piping for reactant gas circulation which is prepared in the interior of said separator and connects opening and said reactant gas supply hole of said separator flank, The solid oxide fuel cell characterized by having abbreviation spiral-like the concave for reactant gas circulation which whirls around centering on said reactant gas supply hole on the front face of said separator which counters said single cel.
[Claim 2] It is the solid oxide fuel cell according to claim 1 which said concave for reactant gas circulation is prepared in the field within predetermined distance from said reactant gas supply hole, and is characterized by setting up said predetermined distance according to the power density of said solid oxide fuel cell.
[Claim 3] Said separator is a solid oxide fuel cell given in any of claim 1 characterized by having had said concave for reactant gas circulation on two front faces which counter, having regarded as said concave for reactant gas circulation on said one front face, and said concave for reactant gas circulation on said front face of another side from both the front-faces side, and being mutually formed in the same configuration, or claim 2 they are.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About the solid oxide fuel cell which consists of solid electrolytes, such as a monotonous mold, especially, this invention puts a positive-electrode [of a solid electrolyte], and negative-electrode side from both sides, and relates to the separator which supplies reactant gas which is different in each by the side of a positive electrode and a negative electrode.
[0002]
[Description of the Prior Art] Like the solid oxide fuel cell indicated by the former, for example, JP,3-129675,A, the solid oxide fuel cell which made unnecessary the gas seal between a solid electrolyte object and a separator is known. Drawing 6 is the important section perspective view of the solid oxide fuel cell 1 with an example of the above-mentioned conventional technique. The laminating of the single cel 2 which comes to have the positive electrode and negative electrode which put the solid electrolyte plate which consists of oxide solid electrolytes, such as a zirconia, from both sides, and the separate plate 3 is carried out by turns, and this solid oxide fuel cell 1 is constituted. On the single cel 2 and the front face of the separate plate 3 which counters, two or more concaves in a circle mutually connected to the medial axis P and the same axle of a solid oxide fuel cell 1 are formed. Near the medial-axis P, the fuel gas supply pipe 4 which supplies fuel gas to the concave in a circle by the side of one front face of the separate plate 3, and the oxidant gas supply pipe 5 which supplies oxidant gas to the concave in a circle by the side of the front face of another side are arranged so that the interior may be penetrated along with a medial axis P. And the fuel gas and oxidant gas which were circulated toward the periphery side on the front face of the separate plate 3 from the reactant gas outlet prepared in each gas supply lines 4 and 5 near the medial-axis P are discharged outside from the fuel gas exhaust port 6 which carried out opening on the peripheral face of the separate plate 3, and the oxidant gas exhaust port 7.
[0003]
[Problem(s) to be Solved by the Invention] By the way, in the solid oxide fuel cell 1 with an example of the above-mentioned conventional technique, the reactant gas outlet which makes reactant gas blow off from each gas supply lines 4 and 5 on the front face of the separate plate 3 is prepared only near the medial-axis P, and has composition which is made to diffuse fuel gas and oxidant gas toward the periphery section from the core of the separate plate 3, and is supplied. For this reason, if a solid electrolyte plate is enlarged in order to heighten a generation-of-electrical-energy output, for example, homogeneity and the problem of it becoming impossible to supply efficiently will produce fuel gas and oxidant gas in the generation-of-electrical-energy side of a solid electrolyte plate. That is, near the reactant gas outlet, the concentration of fuel gas and oxidant gas becomes high relatively, it takes toward the periphery section from a core, reactant gas is consumed by the generation-of-electrical-energy reaction, and the concentration of fuel gas and oxidant gas becomes low relatively in the fuel gas exhaust port 6 and about seven oxidant gas exhaust port. Then, there is a possibility that dispersion in the generation-of-electrical-energy output by the location may increase inside the enlarged single cel 2, the power density per single cel 2 may decline, and a generation-of-electrical-energy output may

decline. This invention was made in view of the above-mentioned situation, supplies reactant gas to homogeneity to a solid electrolyte object, and it aims at offering the solid oxide fuel cell which can equalize distribution of the generation-of-electrical-energy output inside a single cel.
[0004]
[Means for Solving the Problem] In order to attain the purpose which solves the above-mentioned technical problem and starts, the solid oxide fuel cell of this invention according to claim 1 It is the solid oxide fuel cell equipped with the single cel which consists of a solid electrolyte put with the positive electrode and the negative electrode, and the separator by which the laminating was carried out to said said positive-electrode [of this single cel], and negative-electrode side. Two or more reactant gas supply holes prepared on the front face of said separator, and piping for reactant gas circulation which is prepared in the interior of said separator and connects opening and said reactant gas supply hole of said separator flank, It is characterized by having abbreviation spiral-like the concave for reactant gas circulation which whirls around centering on said reactant gas supply hole on the front face of said separator which counters said single cel.
[0005] According to the solid oxide fuel cell of the above-mentioned configuration, the circulation way of two or more reactant gas is formed of one or more spiral concaves for reactant gas circulation which whirl around centering on each reactant gas supply hole on the front face of a separator, and the front face of a single cel where the laminating of the separator was carried out. Reactant gas is supplied to each reactant gas supply hole from opening of a separator flank by piping for reactant gas circulation for example, inside a separator, is led to the concave for reactant gas circulation from piping for reactant gas circulation in each reactant gas supply hole, and as it whirls around along with the spiral concave for reactant gas circulation, while being circulated smoothly, it acts on the solid electrolyte of a single cel.
[0006] In this case, since it is distributed to two or more reactant gas supply holes on the front face of a separator, the reactant gas supplied by piping for reactant gas circulation continues all over the generation-of-electrical-energy side of a solid electrolyte, and concentration can supply reactant gas to homogeneity in the high condition, and can ** it to equalization of concentration distribution of reactant gas. In order for this to prevent the concentration of reactant gas falling near the exhaust port of reactant gas, the need for increasing the flow rate of reactant gas etc. is lost, and it can prevent that the utilization factor which uses reactant gas effectively falls. And it is controlled that the partial pressure (concentration) difference of reactant gas will become large by the time the spiral concave for reactant gas circulation serves as a compact configuration, the reactant gas supplied from the reactant gas supply hole is circulated in the concave for reactant gas circulation and it is discharged outside because a reactant gas supply hole plurality-izes. For this reason, it can prevent that it is controlled that the degree of a generation-of-electrical-energy reaction changes with locations, and big dispersion arises in a generation-of-electrical-energy output.
[0007] Furthermore, in the solid oxide fuel cell of this invention according to claim 2, said concave for reactant gas circulation is prepared in the field within predetermined distance from said reactant gas supply hole, and it is characterized by setting up said predetermined distance according to the power density of said solid oxide fuel cell. According to the solid oxide fuel cell of the above-mentioned configuration, the number of reactant gas supply holes, the number of the circumference of the concave for reactant gas circulation, etc. are set as extent which can maintain the condition of high power density to homogeneity, for example throughout a single cel. For example, abbreviation spiral-like the concave for reactant gas circulation which whirls around centering on these reactant gas supply holes by making the number of reactant gas supply holes increase serves as a compact configuration. It can prevent that it is controlled that the partial pressure (concentration) difference of reactant gas will become large by the time the reactant gas supplied from the reactant gas supply hole is circulated in the concave for reactant gas circulation and discharged outside, and the difference by the location of power density becomes large.
[0008] Furthermore, in the solid oxide fuel cell of this invention according to claim 3, it is characterized by having equipped said separator with said concave for reactant gas circulation on two front faces which counter, having regarded it as said concave for reactant gas circulation on said one front face, and

said concave for reactant gas circulation on said front face of another side from both the front-faces side, and forming it in the same configuration mutually. According to the solid oxide fuel cell of the above-mentioned configuration, while puts a single cel from both sides. Another side with the concave for reactant gas circulation the concave for reactant gas circulation Even if it is the case where the internal pressure resulting from the differential pressure of the reactant gas supplied to one concave for reactant gas circulation and the reactant gas supplied to the concave for reactant gas circulation of another side occurs since it is arranged so that it may cross mutually for example A solid electrolyte can deform or it can prevent damaging.

[0009]

[Embodiment of the Invention] It explains referring to the solid oxide fuel cell ****** accompanying drawing concerning 1 operation gestalt of this invention hereafter. Drawing 1 is the important section sectional side elevation of the solid oxide fuel cell 10 concerning 1 operation gestalt of this invention, drawing 2 is the side elevation of the separator 12 shown in drawing 1 , drawing 3 is a top view by the side of the fuel electrode of the separator 12 shown in drawing 2 , drawing 4 is a top view by the side of the air pole of the separator 12 shown in drawing 2 , and is drawing emphasizing and showing the passage of the reactant gas in the interior, and drawing 5 is the A-A line sectional view of the separator 12 shown in drawing 3 . The solid oxide fuel cell 10 by the gestalt of this operation is equipped with positive-electrode 11B and negative-electrode 11C, the separator 12, and the disc-like porosity metal plate 13 of the both sides of disc-like solid electrolyte plate 11A which is formed in the shape of an appearance approximate circle column, for example, consists of oxide solid electrolytes, such as a zirconia, and this solid electrolyte plate 11A, and is constituted. And solid electrolyte plate 11A and two electrodes 11B and 11C make the porosity metal plate 13 one single cel 11 intervene between nothing, and this single cel 11 and separator 12, and the laminating of the single cel 11 and the separator 12 is carried out by turns.

[0010] As shown in drawing 2 , the fuel gas which the separator 12 which consists of stainless steel etc. is formed in disc-like, and the surface 12A and rear-face 12B side (fuel electrode side) (air pole side) is formed in an abbreviation same configuration in the thickness direction of a separator 12, for example, contains hydrogen in the surface 12A side is supplied, and the oxidant gas which contains oxygen in the rear-face 12B side is supplied. The separator 12 consists of the approximate circle ring tabular periphery section 14 of predetermined die length, and the approximate circle tabular inner circumference section 15 from peripheral face 12C at the direction inside of a path, and the inner circumference section 15 is formed in the thickness direction of a separator 12 more thinly than the periphery section 14. That is, from surface 14A of the periphery section 14, as one step of surface 15A of the inner circumference section 15 is dented, it is formed, and similarly, from rear-face 14B of the periphery section 14, as one step of rear-face 15B of the inner circumference section 15 is dented, it is formed. And this part dented one step is equipped with the porosity metal plate 13, and the thickness of a layered product which consists of the inner circumference section 15 and two porosity metal plates 13 and 13 which put this inner circumference section 15 from both sides is equal to the thickness of the periphery section 14, or he is trying to become thicker than the thickness of the periphery section 14 somewhat.

[0011] In the periphery section 14, as opening is carried out in peripheral face 12C as shown in drawing 3 , one fuel gas feed-holes 16a extended in the direction of a path is prepared and the interior of a fuel electrode side is further shown in drawing 4 For example, one oxidant gas feed-holes 16b is arranged in the location which carries out opening in peripheral face 12C, and is extended in the direction of a path in the interior of an air pole side and which shifted from fuel gas feed-holes 16a 180 degrees in the hoop direction of a separator 12.

[0012] As shown in drawing 3 , inside the periphery section 14, the fuel gas exhaust nozzles 17a, --, 17a of plurality (for example, six pieces) which penetrate the periphery section 14 in the direction of a path keep predetermined spacing, and are arranged in the location which shifted to the surface 14A side at the hoop direction, and these fuel gas exhaust nozzles 17a, --, 17a can adjust the flow rate of the fuel gas discharged to the specified quantity. Similarly, as shown in drawing 4 , inside the periphery section 14, the oxidant gas exhaust nozzles 17b, --, 17b of plurality (for example, six pieces) which penetrate the

periphery section 14 in the direction of a path keep predetermined spacing, and are arranged in the location which shifted to the rear-face 14B side at the hoop direction, and these oxidant gas exhaust nozzles 17b, --, 17b can adjust the flow rate of the oxidant gas discharged to the specified quantity.
[0013] And fuel gas feed-holes 16a is arranged in the abbreviation mid-position of two fuel gas exhaust nozzles 17a and 17a which adjoin in the hoop direction of a separator 12, and oxidant gas feed-holes 16b is arranged similarly in the abbreviation mid-position of two oxidant gas exhaust nozzles 17b and 17b which adjoin in the hoop direction of a separator 12. In addition, although not limited, especially the path lay length of the periphery section 14 is set up so that it may refer to the temperature characteristic of solid electrolyte plate 11A etc. and a big temperature gradient may not arise in a periphery [of solid electrolyte plate 11A], and inner circumference side, in case the fuel gas discharged from fuel gas exhaust nozzle 17a and the oxidant gas discharged from oxidant gas exhaust nozzle 17b cause a chemical reaction and generates heat for example.
[0014] In the center position on surface 15A of the inner circumference section 15, and the location of plurality (for example, six pieces) which kept predetermined distance on the periphery of the abbreviation (2/3) r to the radius r of the inner circumference section 15, and has been arranged at equal intervals A total of seven crevices 18a, --, 18a are formed, for example, and these bases 18A, --, 18A are arranged in the location for which it has each base 18A and which shifted to the surface 15A side inside the inner circumference section 15, and are made the same. In the center position on rear-face 15B of the inner circumference section 15, and the location of plurality (for example, six pieces) which kept predetermined distance on the periphery of the abbreviation (2/3) r to the radius r of the inner circumference section 15, and has been arranged at equal intervals A total of seven crevices 18b, --, 18b are formed, for example, and such base 18B is arranged in the location for which it has each base 18B and which shifted to the rear-face 15B side inside the inner circumference section 15. That is, crevice 18b by the side of crevice 18a by the side of surface 15A and rear-face 15B is made not to be opened for free passage.
[0015] And as are shown, for example in drawing 4 , and six crevices 18a, --, 18a where the radius has been arranged on the periphery of Abbreviation (2/3) r are connected to the interior of the fuel electrode side of the inner circumference section 15, piping 19a for in-a-circle fuel gas is arranged in it. Furthermore, as crevice 18a and piping 19a for in-a-circle fuel gas which have been arranged in the center position of the inner circumference section 15 are connected, the piping 19b, --, 19b for fuel gas of plurality (4 [for example,]) extended from crevice 18a of a center position to a radial is arranged, and piping 19c for fuel gas which connects piping 19a for in-a-circle fuel gas and fuel gas feed-holes 16a of the periphery section 14 is arranged. Similarly, as six crevices 18b, --, 18b where the radius has been arranged on the periphery of Abbreviation (2/3) r are connected to the interior of the air pole side of the inner circumference section 15, 19d of piping for in-a-circle oxidant gas is arranged in it. Furthermore, as crevice 18b and 19d of piping for in-a-circle oxidant gas arranged in the center position of the inner circumference section 15 are connected, the piping 19e, --, 19e for oxidant gas of plurality (4 [for example,]) extended from crevice 18b of a center position to a radial is arranged, and 19f of piping for oxidant gas which connects oxidant gas feed-holes 16b of the periphery section 14 with 19d of piping for in-a-circle fuel gas is arranged.
[0016] Here, six crevices 18a, --, 18a where the radius has been arranged on the periphery of Abbreviation (2/3) r are arranged so that it may pass along the abbreviation mid-position of two fuel gas exhaust nozzles 17a and 17a of the periphery section 14 where the straight line which connects each crevice 18a and the center position of the inner circumference section 15 adjoins in the hoop direction of a separator 12. That is, one of these straight lines passes fuel gas feed-holes 16a. Furthermore, the piping 19b, --, 19b for fuel gas of four is arranged so that each piping 19b for fuel gas may intersect the direction where piping 19c for fuel gas is extended, while being arranged so that it may make equiangular, i.e., 90 degrees, to the hoop direction of a separator 12 mutually. Namely, the piping 19b and 19b for fuel gas of two which makes 180 degrees mutually among the piping 19b, --, 19b for fuel gas of four The radius is connected to each crevices 18a and 18a on the periphery of Abbreviation (2/3) r, and piping 19c for fuel gas is connected to each crevice 18a to which the piping 19b and 19b for fuel

gas was connected, and crevice 18a other than 18a. First, the fuel gas supplied by this from piping 19for fuel gas c connected with fuel gas feed-holes 16a is circulated in the shape of a circular ring in the inside of piping 19a for in-a-circle fuel gas, and is introduced into the piping 19b, --, 19b for fuel gas of four from piping 19for in-a-circle fuel gas a after this.

[0017] It is made the same. Each of a total of seven crevices 18b, --, 18b by the side of an air pole, piping for in-a-circle oxidant gas of 19d, and the piping 19e, --, 19e for oxidant gas of four As it counters with a total of seven crevices 18a, --, 18a by the side of a fuel electrode, piping 19for in-a-circle fuel gas a, and the piping 19b, --, 19b for fuel gas of four, it is arranged by the fuel electrode [of a separator 12], and air pole side at the field symmetry. However, 19f of piping for oxidant gas connected with oxidant gas feed-holes 16b of the periphery section 14 is arranged about the central point of a separator 12 at point symmetry to piping 19c for fuel gas connected with fuel gas feed-holes 16a.

[0018] As shown in drawing 3 , and on surface 15A of the inner circumference section 15 The concaves 21a, --, 21a for fuel gas of plurality (for example, 16 pieces each) spirally extended from each crevice 18a Between adjacent each concave 21a and 21a, predetermined spacing is set, it is formed, opening of the end of each concave 21a for fuel gas is carried out within crevice 18a, and the other end is connected to each crevice 18a and in-a-circle concave 21b for fuel gas of the shape of a circular ring arranged at the same axle. In addition, within crevice 18a, on the internal surface of crevice 18a, opening of the concaves 21a, --, 21a for fuel gas of plurality (for example, 16 pieces) sets predetermined spacing to a hoop direction, and is arranged. Moreover, base 21A of concave 21a for fuel gas is arranged in the location which shifted to the surface 15A side rather than piping 19a for fuel gas in the thickness direction inside the inner circumference section 15.

[0019] Here, the concaves 21b, --, 21b for fuel gas of plurality (for example, seven pieces) in a circle arranged on surface 15A of the inner circumference section 15 at each crevices 18a, --, 18a and the same axle are arranged so that it may circumscribe mutually, and they are mutually connected in these circumscription parts. That is, as the periphery of in-a-circle concave 21b for fuel gas arranged at the center position and the same axle on surface 15A of the inner circumference section 15 is surrounded, six concaves 21b, --, 21b for fuel gas in a circle are arranged. Furthermore, a radius is inscribed in six concaves 21b, --, 21b for fuel gas in a circle arranged on the periphery of Abbreviation (2/3) r. In-a-circle concave 21c for periphery side fuel gas mutually connected in these inscribed parts It is arranged at the center position and the same axle on surface 15A of the inner circumference section 15, and two or more fuel gas exhaust nozzles 17a, --, 17a of the periphery section 14 are connected to this in a circle concave 21for periphery side fuel gas c. Moreover, it is [in / in the surface 15A top of the inner circumference section 15 / the direction of a path of a separator 12] a location by the side of inner circumference in piping 19a for in-a-circle fuel gas from in-a-circle concave 21c for periphery side side and periphery side fuel gas. Among the adjoining concaves 21b and 21b for fuel gas in a circle, the arc concaves 21d, --, 21d for fuel gas which make a part of two or more concaves in a circle which kept predetermined spacing in the direction of a path mutually, and have been arranged at in-a-circle concave 21c for periphery side fuel gas and the same axle are arranged. And these arc concaves 21d, --, 21d for fuel gas are connected with the adjacent concaves 21b and 21b for fuel gas in a circle.

[0020] As shown in drawing 4 , similarly on rear-face 15B of the inner circumference section 15 The concaves 21e, --, 21e for oxidant gas of plurality (for example, 16 pieces each) spirally extended from each crevice 18b Between adjacent each concave 21e and 21e, predetermined spacing is set, it is formed, opening of the end of each concave 21e for oxidant gas is carried out within crevice 18b, and the other end is connected to 21f of concaves for oxidant gas of the shape of a circular ring arranged at each crevice 18b and the same axle in a circle. And it is inscribed in six concaves 21f, --, 21f for oxidant gas in a circle by which connect in 21f of concaves for oxidant gas of plurality (for example, seven pieces) in a circle, --, a circumscription part with mutual 21f, and the radius has been arranged on the periphery of Abbreviation (2/3) r. 21g of concaves for periphery side oxidant gas in a circle connected mutually is arranged in these inscribed parts, and two or more oxidant gas exhaust nozzles 17b, --, 17b of the periphery section 14 are connected to 21g of this concave for periphery side oxidant gas in a circle.

[0021] Moreover, in the direction of a path of a separator 12, it is a location by the side of inner

circumference from piping 19a for in-a-circle oxidant gas in a periphery side and 21g of concaves for periphery side oxidant gas in a circle. Among the adjoining concaves 21f and 21f for oxidant gas in a circle, the arc concaves 21h, --, 21h for oxidant gas which make a part of two or more concaves in a circle which kept predetermined spacing in the direction of a path mutually, and have been arranged at 21g of concaves for periphery side oxidant gas in a circle and the same axle are arranged. And these arc concaves 21h, --, 21h for oxidant gas are connected with the adjacent concaves 21f and 21f for oxidant gas in a circle. Concave 21a for fuel gas by the side of surface 15A of the inner circumference section 15 and concave 21e for oxidant gas by the side of rear-face 15B are mutually formed in an equal configuration, for example, and the eddy is made to be wound around them here in the equal direction mutually. That is, when concave 21a for fuel gas seen from the surface 12A side of a separator 12 is formed so that it may estrange winding an eddy around a clockwise rotation from crevice 18a as shown, for example in drawing 3 and drawing 4 , it is formed so that concave 21e for oxidant gas seen from the rear-face 12B side of a separator 12 may also be estranged winding an eddy around a clockwise rotation from crevice 18b.

[0022] And as shown in drawing 1 and drawing 5 , it is made to carry out field contact at each of surface 15A of the inner circumference section 15, and rear-face 15B. The disc-like porosity metal plates 13 and 13 which have an outer diameter equal to the inner circumference section 15 are arranged. A fuel gas circulation way is formed by rear-face 13B of the porosity metal plate 13, and each concaves 21a, 21b, 21c, and 21d for fuel gas, and the oxidant gas circulation way is formed by rear-face 13B of the porosity metal plate 13, and each concaves 21e, 21f, 21g, and 21h for oxidant gas. in addition -- although especially the thickness of the porosity metal plate 13 is not limited, if it is preferably set below to one half of the depth of each concaves 21a and 21b and the thickness of the porosity metal plate 13 becomes larger than the one half of the depth of each concaves 21a and 21b here -- each -- there is a possibility that the flow rate of concave 21a, --, the fuel gas that flows the inside of 21h, or oxidant gas may fall, and a generation-of-electrical-energy output may decline. Moreover, the outer diameter of solid electrolyte plate 11A is formed so that it may become larger than the outer diameter of the porosity metal plate 13, when a layered product is pressurized and held near the periphery section of the single cel 11 by which the laminating was carried out to the separator 12 from both sides in the periphery section 14 of a separator 12, it is carrying out field contact mostly, and it forms an airtight closed space between the single cel 11 and the inner circumference section 15 of a separator 12.

[0023] In addition, the flute width L and depth D of concave 21for fuel gas a and concave 21b for oxidant gas Although not limited especially, depth-of-flute D It is set up so that the fuel gas within a separator 12 and the internal pressure of oxidant gas may be maintained to a predetermined value. A flute width L The gross area of each each concaves [on the front face of a separator 12 / 21a, --, 21d] bases 21A, --, 21D and the area of surface 15A of the inner circumference section 15 become equal preferably. It is set up so that the gross area of each each concaves [21e, --, 21h] bases 21E, --, 21H and the area of rear-face 15B may become equal. here, rather than the area of surface 15A of the inner circumference section 15, a flute width L so that the gross area of each each concaves [21a --, 21d] bases 21A, --, 21D may become small If it is set up so that the gross area of each each concaves [21e, --, 21h] bases 21E, --, 21H may become small rather than the area of rear-face 15B If it is set up so that it may become impossible to use solid electrolyte plate 11A effectively and the gross area of each bases 21A, --, 21D or the gross area of each bases 21E, --, 21H may become large conversely, the problem that current collection effectiveness falls will arise.

[0024] for example, when the diameter of solid electrolyte plate 11A is set to about 150mm The diameter of in a circle concave 21for fuel gas b and 21f of concaves for oxidant gas in a circle is set to about 50mm, and it sets depth-of-flute D to 1mm, setting a flute width L as 1mm. If 16 spiral concaves 21a, --, 21a each for fuel gas and the concaves 21e, --, 21e for oxidant gas are formed, only an abbreviation semicircle will go the inside of a separator 12 around, and fuel gas and oxidant gas will be discharged from each exhaust nozzles 17a and 17b of the periphery section 14. Here, it can control that a partial pressure (concentration) difference will become large by the time the fuel gas and oxidant gas which were supplied from each crevices 18a and 18b are discharged outside from each exhaust nozzles

17a and 17b by an in a circle [both] concaves [21b and 21f] diameter being set as about 50mm, and the condition that power density is high can be maintained in all the fields of the single cel 11.
[0025] The solid oxide fuel cell 10 by the gestalt of this operation is equipped with the above-mentioned configuration, next explains actuation of this solid oxide fuel cell 10. First, the fuel gas which contains hydrogen from fuel gas feed-holes 16a prepared in the periphery section 14 of a separator 12 is supplied to piping 19c for fuel gas. And the fuel gas supplied to piping 19c for fuel gas is supplied into each crevice 18a arranged on a periphery while it is circulated in the shape of a circular ring in the inside of piping 19a for in-a-circle fuel gas. Moreover, the fuel gas introduced into the piping 19b, --, 19b for fuel gas of four from piping 19for in-a-circle fuel gas a is supplied to crevice 18a of a center position. And the fuel gas supplied to each crevice 18a is distributed to 16 spiral concaves 21a, --, 21a for fuel gas.
[0026] The oxidant gas which contains oxygen on the other hand from oxidant gas feed-holes 16b prepared in the periphery section 14 of a separator 12 is supplied to 19f of piping for oxidant gas. And oxidant gas is supplied from 19f of piping for oxidant gas into crevice 18b by the side of rear-face 15B, and is distributed to 16 spiral concaves 21e, --, 21e for oxidant gas from each crevice 18b. Here, the oxygen contained in oxidant gas moves the interior of solid electrolyte plate 11A to the negative-electrode 11C side from the positive-electrode 11B side with the gestalt of oxygen ion, and reacts chemically with the hydrogen gas contained in fuel gas at the negative-electrode 11C side. While a solid oxide fuel cell 10 is warmed from the interior by generation of heat accompanying this chemical reaction, the potential difference arises between positive-electrode 11B and negative-electrode 11C.
[0027] And in the surface 12A side of a separator 12, the steam generated by unreacted fuel gas and an unreacted chemical reaction is discharged from fuel gas exhaust nozzle 17a, and unreacted oxidant gas is discharged from oxidant gas exhaust nozzle 17b at the rear-face 12B side of a separator 12. The fuel gas and oxidant gas which were discharged from both the nozzles 17a and 17b are mixed on the outside of a separator 12, and a solid oxide fuel cell 10 is warmed from a periphery side by generation of heat accompanying a chemical reaction.
[0028] Since two or more crevices 18a and 18b which distribute and supply fuel gas and oxidant gas to a fuel electrode [of a separator 12] and air pole side are formed according to the solid oxide fuel cell 10 by the gestalt of this operation as mentioned above, it can continue all over the generation-of-electrical-energy side of solid electrolyte plate 11A, and concentration can supply fuel gas and oxidant gas to homogeneity in the high condition. It can prevent that the utilization factor which uses fuel gas and oxidant gas effectively falls by this. And it is controlled that the spiral concaves 21a, --, 21a for fuel gas and the concaves 21e, --, 21e for oxidant gas serve as a compact configuration, will be consumed by the time fuel gas and oxidant gas are discharged outside, and a concentration difference becomes large. It can prevent that it is controlled by this that the degree of a generation-of-electrical-energy reaction changes with locations, and big dispersion arises in a generation-of-electrical-energy output.
[0029]
[Effect of the Invention] According to the solid oxide fuel cell of this invention according to claim 1, as explained above, it continues all over the generation-of-electrical-energy side of a solid electrolyte, and concentration can supply reactant gas to homogeneity in the high condition, and can ** to equalization of concentration distribution of reactant gas. It can prevent that the utilization factor which uses reactant gas effectively falls by this. And it is controlled that the partial pressure (concentration) difference of reactant gas will become large by the time the reactant gas supplied from the reactant gas supply hole is circulated in the concave for reactant gas circulation and discharged outside. For this reason, it can prevent that it is controlled that the degree of a generation-of-electrical-energy reaction changes with locations, and big dispersion arises in a generation-of-electrical-energy output. Furthermore, according to the solid oxide fuel cell of this invention according to claim 2, it is controlled that the partial pressure (concentration) difference of reactant gas will become large by the time the reactant gas supplied from the reactant gas supply hole is circulated in the concave for reactant gas circulation and discharged outside, and it can equalize power density. Furthermore, according to the solid oxide fuel cell of this invention according to claim 3, even if it is the case where the internal pressure which originates in the differential pressure of reactant gas by the fuel electrode [of a separator] and air pole side occurs, a

solid electrolyte can deform or it can prevent damaging.

[Translation done.]